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An American National Standard

To Viorica Visan  
as promised

Joke

## Standard Test Methods for BREAKING LOAD AND ELONGATION OF TEXTILE FABRICS<sup>1</sup>

This standard is issued under the fixed designation D 1682; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 These test methods cover procedures for determining the breaking load and elongation of textile fabrics using the Grab, Ravelled Strip, and Cut Strip methods, presented in two sections as follows:

1.1.1 *Part I* describes aspects of the procedure which are common to all three methods.

1.1.2 *Part II* describes those details of procedure especially applicable to the method under discussion.

NOTE 1—The values stated in U.S. customary units are to be regarded as the standard.

### PART I—GENERAL

### 2. Applicable Documents

#### 2.1 ASTM Standards:

D 76 Specification for Tensile Testing Machines for Textiles<sup>2,3</sup>

D 123 Terminology Relating to Textiles<sup>2,3</sup>

D 259 Specification for Woven Tapes<sup>2</sup>

D 315 Specification for Woven Asbestos Tape<sup>3</sup>

D 461 Methods of Testing Felt<sup>2</sup>

D 579 Specification for Greige Woven Glass Fabrics<sup>2</sup>

D 580 Methods of Testing and Tolerances for Woven Glass Tapes<sup>3</sup>

D 629 Methods for Quantitative Analysis of Textiles<sup>2</sup>

D 1117 Methods of Testing Nonwoven Fabrics<sup>2</sup>

### 3. Definitions

3.1 *grab test*—in fabric testing, a tension test in which only a part of the width of the specimen

is gripped in the clamps. For example, if the specimen width is 4 in. (100 mm) and the width of the jaw faces 1 in. (25 mm), the specimen is gripped centrally in the clamps.

3.2 *strip test*—a tension test in which the full width of the specimen is gripped in the clamps.

3.3 *modified grab test*—a test in which only a part of the width of the specimen is gripped in the clamps and in which lateral slits are made in the specimen to sever all yarns bordering the portion whose strength is to be tested, reducing to a practical minimum the "fabric assistance" inherent in the grab method.

3.4 *raveled strip test*—a strip test in which the specified specimen width is secured by raveling away yarns.

3.5 *cut strip test*—a strip test in which the specimen width is secured by cutting the fabric.

3.6 *constant-rate-of-extension tensile testing machine (CRE)*—a testing machine in which the rate of increase of specimen length is uniform with time.

3.7 *constant-rate-of-traverse tensile testing machine (CRT)*—a testing machine in which the pulling clamp moves at a uniform rate and the load is applied through the other clamp which moves appreciably to actuate a weighing mechanism, so that the rate of increase of load or

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<sup>2</sup> Annual Book of ASTM Standards, Vol 07.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 07.02.

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elongation is dependent upon the extension characteristics of the specimen.

3.8 *constant-rate-of-load tensile testing machine (CRL)*—a testing machine in which the rate of increase of the load being applied to the specimen is uniform with time after the first 3 s.

3.9 For definitions of other terms used in this method, refer to Terminology D 123.

#### 4. Summary of Method

4.1 A continually increasing load is applied longitudinally to the specimen, and the test is carried to rupture in a specific time. Values for the breaking load and elongation of the test specimen are obtained from machine scales or dials or autographic recording charts.

#### 5. Uses and Significance

5.1 Most woven, nonwoven, or felted textile fabrics may be tested by at least one of the methods. The methods are not recommended for knitted fabrics. Some modification of the techniques is likely to be necessary for any fabric having a strength in excess of 1000 lb/in. (179 kg/cm) width. Special precautionary measures are provided for use when necessary with strong fabrics or fabrics made from glass fibers, to prevent them from slipping in the clamps or being damaged as a result of being gripped in the clamps.

5.2 All of the procedures are applicable for testing fabrics either dry or wet. They may be used with constant-rate-of-traverse, constant-rate-of-load, or constant-rate-of-extension type tension machines. The results obtained may, however, depend upon the type of machine used for the test. Constant-time-to-break has been specified because it is the best known way of providing good agreement between the results from different types of tensile testers. However, data obtained on constant-rate-of-load testers may differ from that obtained on constant-rate-of-traverse or constant-rate-of-extension testers when testing fabrics made from fibers whose behavior is strongly dependent upon the rate of extension used, for example, high-density polyethylene. An optional procedure for the constant-rate-of-traverse tester using a machine speed of  $12 \pm \frac{1}{2}$  in. (305  $\pm$  10 mm)/min is permitted whenever a constant-time-to-break is not specified.

5.3 *Grab Method*—The grab method is appli-

cable whenever it is desired to determine the "effective strength" of the fabric in use, that is, the strength of the yarns in a specific width together with the additional strength contributed by adjacent yarns. The breaking load determined by the grab method is not a reflection of the strength of the yarns actually gripped between clamps and cannot be used for direct comparison with yarn strength determinations. Grab tests are as precise as raveled strip tests and the specimens require much less time to prepare though they require more fabric per specimen. There is no simple relationship between grab tests and strip tests since the amount of fabric assistance depends on the type of weave, fabric count, mobility of yarns, etc.

5.4 *Raveled Strip*—The raveled strip method is applicable whenever it is desired to determine the breaking load required to rupture a specific width of fabric. The information is particularly useful for comparison of the effective strength of the yarns in the fabric with their strength before weaving. The method is not recommended for fabrics having less than 20 yarns across the width of the specimen. If the specimen cannot be obtained with a 1-in. (25.4-mm) strip, a 2-in. (50.8-mm) strip should be used. If a fabric cannot be raveled readily, use either a grab or cut strip test.

NOTE 2—The 2-in. (50.8-mm) strip may be used for any fabric if a machine of sufficient capacity is available.

NOTE 3—The observed load of a 2-in. (50.8-mm) specimen, in general, is not double the observed load of a 1-in. (25.4-mm) specimen and the results should accordingly be reported as observed on a 2-in. strip, without mathematical adjustment to a 1-in.

NOTE 4—If, by mutual consent, it is agreed to perform a test on strips containing less than 20 yarns across the width to be tested, the actual number of yarns shall be stated in the report.

NOTE 5—Tape, ribbons, and other narrow fabrics less than 2-in. (50.8-mm) wide, not covered by Specification D 259, Methods D 580, or Specification D 315, are tested full width.

5.5 *Cut Strip*—The cut strip method is applicable instead of the raveled strip method for heavily filled fabrics, felted fabrics, or any fabric that cannot be readily raveled. It can be used when the fabric can be raveled, but this procedure is not recommended. The recommendation regarding the minimum number of yarns in a specimen discussed in 5.4 for raveled strips applies equally to cut strips.

5.6 *Modified Grab*—The modified grab



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method is applicable where it is desired to determine the breaking load required to rupture a specific width of fabric for those constructions in which the application of testing stress on raveled strip specimens produces further unraveling. This method is particularly applicable to high strength fabrics.

## 6. Apparatus

6.1 *Tensile Testing Machine (CRE, CRT, or CRL)*—One of the three types of testing machines described in Specification D 76, shall be used.

6.2 *Speed Adjuster*, for varying the speed of operation of the testing machine in order to break the specimens in  $20 \pm 3$  s.

6.3 *Stop Watch*, for measuring the time required to break each specimen.

## 7. Sampling, Selection, and Number of Specimens

7.1 Take samples as directed in any applicable material specifications or in their absence secure two or more samples separated by several yards along the length of each cut of fabric to be sampled. Each sample shall extend the width of the fabric and  $\frac{1}{2}$  yd (450 mm) along the selvage.

NOTE 6—Results secured on small hand samples should be considered merely as representative of the sample submitted and cannot be assumed to be representative of the fabric piece from which the hand sample was taken.

7.2 Unless otherwise agreed upon (for example, provided for by an applicable material specification), the number of test specimens shall be such that the mean of the test results will, with a 95 % probability, be no more than 5 % below the "true" average breaking load (as would be determined by an infinite number of tests). This is equivalent to a precision of  $\pm 5$  % at a probability level of 90 %.

$$n = 0.11 v^2$$

where:

$n$  = number of test specimens, and

$v$  = coefficient of variation of individual test results, determined from extensive past records on similar material.

NOTE 7—The variability of elongation likely to be encountered is not sufficiently well known at the present time to be able to estimate the degree of precision to be expected. Variability of elongation is likely to be somewhat higher than variability of breaking load, how-

ever, and the precision of the result for the same number of tests is likely to be lower.

7.3 If  $v$  is not known, make five tests on warpwise specimens and eight tests on fillingwise specimens.

NOTE 8—This number of tests is based on a coefficient of variation of breaking load of 6.5 % for the warp and 8.5 % for the filling. This is a somewhat higher value of  $v$  than will be found in practice. Knowledge of the actual value of  $v$  for the fabric under test is therefore likely to permit making fewer tests than prescribed in this section. If fewer tests are performed without knowing the "true" value of  $v$ , it must be presumed that the result is obtained with reduced precision, that is, a figure higher than 5 %. The estimated precision must then be calculated as follows and quoted in the report:

For warpwise tests,

$$E = 10.7/\sqrt{n} \quad (1)$$

For fillingwise tests,

$$E = 14.0/\sqrt{n} \quad (2)$$

where:

$E$  = precision, and

$n$  = actual number of tests.

NOTE 9—It is desirable to prepare two or three extra specimens which may be required to establish the proper time when dealing with unfamiliar materials, using the constant-time-to-break technique.

## 8. Conditioning

8.1 Precondition the specimens by bringing them to approximate moisture equilibrium in the standard atmosphere for preconditioning, then bring the specimens to moisture equilibrium for testing in the standard atmosphere for testing. Equilibrium is considered to have been reached when the increase in weight of the specimen in successive weighings made at intervals of not less than 2 h does not exceed 0.1 % of the weight of the specimen.

NOTE 10—It is recognized that in practice textile materials are frequently not weighed to determine when moisture equilibrium has been reached. While such a procedure cannot be accepted in cases of dispute, it may be sufficient in routine testing to expose the material to the standard atmosphere for testing for a reasonable period of time before the specimens are tested. As a guide, the following conditioning periods are suggested:

Fiber	Minimum Conditioning Period, h
Animal fibers (for example, wool) and regenerated proteins	8
Vegetable fibers (for example, cotton)	6
Viscose	8

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Fiber	Minimum Conditioning Period, h <sup>a</sup>
Acetate	4
Fibers having a regain less than 5 % at 65 % relative humidity	2

<sup>a</sup> These periods are approximate and apply only to fabrics spread out in single thickness which are exposed freely to moving air in the standard atmosphere for testing. Heavy fabrics may require conditioning periods longer than those suggested above. If a fabric contains more than one fiber, it should be conditioned for the longest period of time required by any of its components (for example, 8 h for blends containing wool or viscose).

8.2 Specimens to be tested in the wet condition shall be immersed in water until thoroughly wetted (Note 11). In order to obtain thorough wetting it may be desirable to add not more than 0.05 % of a nonionic neutral wetting agent to the water. A test of any specimen shall be completed within 2 min after its removal from the water.

NOTE 11—The conclusive evidence that the time of immersion has been sufficient to wet the fabric thoroughly is that further immersion does not produce any additional changes in breaking strength. This method of determination must be used in cases of dispute. However, for routine testing in the laboratory it may be sufficient to immerse the material for 1 h. The method should be used with caution when testing fabrics that do not wet out uniformly and thoroughly because of the presence of sizing, oil, protective coatings, or water repellents.

Where the strength of wet specimens is required in the absence of sizing, water repellents, etc., subject the cloth to suitable desizing treatments that will not affect the normal treatments that will not affect the normal physical properties of the fabric, before preparing the test specimens (Methods D 629).

## 9. Preparation of Test Specimens

9.1 For woven fabrics, cut specimens with their long dimensions parallel either to the warp or to the filling or cut specimens of both types, as may be required. In general, no two specimens cut parallel to the warp should contain the same set of warp ends, and no two specimens parallel to the filling should contain the same set of filling picks, and when possible, specimens should come from different bobbins. Unless otherwise specified, take specimens no nearer to the selvage or edge of the fabric than one tenth of the width of the fabric.

9.2 For nonwoven fabrics, prepare the specimens as described in Methods D 1117, for felt, see Methods D 461.

## 10. Procedure

10.1 Make all tests in the standard atmosphere

for testing.

10.2 Use clamps provided with jaws having smooth, flat, metallic faces. For all tests, set the distance between the clamps at the start of the test at  $3 \pm 0.05$  in. ( $75 \pm 1$  mm). Select the load range of the testing machine such that the break occurs between 10 and 90 % of full scale load. Set the machine so that the expected breaking load is reached in  $20 \pm 3$  s, unless otherwise specified.

10.3 Secure the specimen centrally in the clamps of the testing machine, taking care that the long dimension is as nearly as possible parallel to the direction of application of the load. Be sure that the tension in the specimen is uniform across the clamped width.

10.4 If a measure of the elongation of the specimen is required, the initial length and therefore the measured elongation depend upon the pretension applied in placing the specimen in the clamps of the machine. In this case, secure the specimen in one clamp of the machine, and apply a pretension to the specimen of approximately  $\frac{1}{2}$  % of the breaking load, or other initial load specified for the particular material in question, before gripping the specimen in the other clamp.

10.5 *Measurement of Breaking Load*—Operate the machine and read the breaking load, and elongation if required, from the mechanism provided for such purpose. Note the actual time to break for the first three specimens, and if the average of these three lies within the limits  $20 \pm 3$  s, break all the remaining specimens under the same conditions. Record the time to break each specimen, and if the average time for the required number of specimens falls outside the limits  $20 \pm 3$  s, discard the results, readjust the rate of operation of the testing machine, and repeat the breaks until a series having a satisfactory average time to break is obtained. If the average of the three tests meets the time criterion set up, these observations shall be considered as completed tests and shall make up part of the required number of tests. Record and report the tests in each direction separately.

10.6 If a specimen slips in the jaws, breaks at the edge of, or in, the jaws, or if for any reason attributed to faulty operation the result falls markedly below the average for the set of specimens, discard the result and take another specimen. Continue this procedure until the required number of acceptable breaks have been obtained.



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**NOTE 12**—The decision to discard a break shall be based on observation of the specimen during the test and upon the inherent variability of the fabric. In the absence of other criteria for rejecting a so-called jaw break, any break occurring within  $\frac{1}{4}$  in. (5 mm) of the jaws which results in a value below 50 % of the average of all the other breaks shall be discarded. No other break shall be discarded unless it is known to be faulty.

**NOTE 13**—It is difficult to determine the precise reason why certain specimens break near the edge of the jaws. If this is caused by damage to the specimen by the jaws, then the results should be discarded. If, however, it is merely due to randomly distributed weak places, it is a perfectly legitimate result. In some cases, it may also be caused by a concentration of stress in the area adjacent to the jaws because they prevent the specimen from contracting in width as the load is applied. In these cases, a break near the edge of the jaws is inevitable and shall be accepted as a characteristic of the particular method of test. This is often the case when testing fabrics using the grab method.

**NOTE 14**—For instructions regarding the preparation of specimens made from glass fiber to minimize damage in the jaws, see Specification D 579.

**10.7** If a fabric manifests any slippage in the jaws or if more than 25 % of the specimens break at a point within  $\frac{1}{4}$  in. (5 mm) of the edge of the jaw, then (1) the jaws may be padded; (2) the fabric may be coated under the jaw face area; or (3) the jaw face may be modified. If any of the modifications listed above are used, state the method of modification in the report.

**10.8 Measurement of Apparent Elongation**—Unless otherwise specified, measure the elongation of the fabric at any stated load by means of a suitable autographic recording device, at the same time as the breaking strength is determined. Measure the elongation from the start of the load-elongation curve as shown on the graphic record.

## 11. Calculation

**11.1 Breaking Load**—Calculate the average of the breaking load observed for all acceptable specimens, that is, the maximum load to cause a specimen to rupture as read directly from the testing instrument.

**11.2 Apparent Elongation**—Calculate the average of the elongations observed for all acceptable specimens, expressed as the percentage increase in length, based upon the initial nominal gage length of the specimen. Report this as the apparent elongation.

**NOTE 15**—The observed elongation calculated as a percentage of the initial nominal gage length of the specimen should be referred to as "apparent elongation." Because the actual length of fabric stretched is usually somewhat greater than this initial length, due

to pull-out of fabric from between the jaws, elongation calculated on initial length may be somewhat in error, depending upon the amount of this pull-out.

## 11.3 Corrected Breaking Load of Wet Specimens:

**11.3.1** If for any reason it is desired to make allowances for shrinkage in obtaining wet breaking strength by the grab method only, calculate the wet strength according to Eq 3:

Corrected breaking load of wet specimens

$$= \frac{\text{breaking load of conditioned specimens} \times \text{yarn count of conditioned specimens}}{\text{yarn count of wet specimens}}$$

**11.3.2** A similar correction may be needed when comparing the breaking strength of conditioned specimens of a fabric after a wet finishing treatment with that of the same fabric before finishing, if the finishing has caused shrinkage.

## 12. Identification of Test Method Used

**12.1** These methods describe procedures for carrying out fabric tension tests using six types of specimen and three alternative types of testing machine. In order to provide easy reference to the specific method used in any instance, the following system of identification is suggested:

### 12.2 Type of test specimen used:

G—Grab test  
 1R—1-in. (25.4-mm) raveled strip test  
 2R—2-in. (50.8-mm) raveled strip test  
 1C—1-in. (25.4-mm) cut strip test  
 2C—2-in. (50.8-mm) cut strip test  
 MG—Modified Grab Test

### 12.3 Type of testing machine used:

T—Constant-rate-of-traverse (CRT)  
 L—Constant-rate-of-load (CRL)  
 E—Constant-rate-of-extension (CRE)

**12.4** All the possible combinations can be identified as follows:

Test Specimen	Type of Tester		
	Constant-Rate-of-Traverse	Constant-Rate-of-Load	Constant-Rate-of-Extension
Grab	G-T	G-L	G-E
1-in. (25.4-mm) raveled strip	1R-T	1R-L	1R-E <sup>a</sup>
2-in. (50.8-mm) raveled strip	2R-T	2R-L	2R-E
1-in. (25.4-mm) cut strip	1C-T	1C-L	1C-E
2-in. (50.8-mm) cut strip	2C-T	2C-L	2C-E
Modified Grab	MG-T	MG-L	MG-E

<sup>a</sup> Example: Method 1R-E refers to a 1-in raveled strip test carried out on a constant-rate-of-extension tester.

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**13. Report**

13.1 Report all of the following applicable items:

13.1.1 The average breaking load for specimens cut in each direction, for all specimens giving acceptable breaks.

13.1.2 The average percent apparent elongation of specimens cut in each direction, for all specimens giving acceptable breaks, if required. Identify this as "apparent breaking elongation," or "apparent elongation at x lb load," as required by the test specifications.

13.1.3 Description of material tested.

13.1.4 Number of specimens cut in each direction.

13.1.5 Test method used, identifying both the type of specimens and the type of testing machine.

13.1.6 Maximum load obtainable in the range used for testing.

13.1.7 Size of jaw faces used, if grab test.

13.1.8 Type of padding used in jaws, modification of specimen gripped in the jaws, or modification of jaw faces, if used.

13.1.9 Number of yarns in the width of the strip, if less than 20.

13.1.10 Average time required to break all specimens, giving acceptable breaks.

13.1.11 Condition of specimen (conditioned or wet).

13.1.12 In the case of tests on wet specimens, state whether allowance was made for shrinkage, and

13.1.13 Whether sizing or finishes have been removed and, if so, by what procedure.

**PART II—REQUIREMENTS FOR SPECIFIC TEST METHODS****14. Scope**

14.1 The general instructions given in Part I of these methods apply to all of the methods described in Part II herein. These instructions are therefore not repeated in the description of each separate method. Only those aspects of preparation and procedure that apply specifically to each individual method are included here.

**15. Selection of Test**

15.1 The test to be used in any particular case should be specified or decided by mutual agreement. In the absence of such specification, the type of test to be used may be selected with the

aid of the information given in Part I. The selection of the type of testing machine will be dictated primarily by the availability of the various types. The procedures described are intended to minimize differences between the results obtained from the three types of machine.

**16. Grab Tests, G**

16.1 *Size of Test Specimens*—Cut each specimen  $4 \pm 0.1$  in. ( $100 \pm 1$  mm) wide by at least 6 in. (150 mm) long (Note 16) with the long dimension parallel to the direction for which the breaking load is required. Draw a line 1.5 in. (37 mm) from the edge of the specimen, running its full length. This must be accurately parallel to the lengthwise yarns.

NOTE 16—The length of the specimen depends upon the type of clamps being used. It must be long enough to extend through the clamps and project at least 0.5 in. (10 mm) at each end. For jaw faces measuring 1 in. (25 mm) in the direction of pull, the specimen length will therefore be at least 6 in. (145 mm) (3-in. gage length plus  $2 \times 1$  in. in clamp plus 2 by 0.5 in projecting (75-mm gage length plus 2 by 25 mm in clamp plus 2 by 10 in projecting).

16.2 When the wet breaking load of the fabric is required in addition to the dry breaking load, cut each test specimen at least twice as long as is required for a dry test (Note 17). Number each specimen and then cut crosswise into two parts, one for determining the conditioned breaking load, and the other for determining the wet breaking load, each portion shall bear the specimen number. In this manner perform each paired break on test specimens containing the same yarns.

NOTE 17—For fabrics which shrink excessively when wet, it shall be necessary to cut the test specimens for obtaining wet load longer in dimension than that for dry load.

16.3 *Size of Jaw Faces*—Each clamp shall have one jaw face measuring 1 in. (25.4 mm) perpendicular to the direction of application of the load, and not less than 1 nor more than 2 in. (25 nor more than 50 mm) parallel to the direction of application of the load (Note 17). The other jaw face of each clamp shall be at least as large as its mate. Each jaw face shall be in line both with respect to its mate in the same clamp and to the corresponding jaw of the other clamp.

NOTE 18—Faces measuring 1 by 2 in. (25.4 by 50 mm) will not necessarily give the same value as 1 by 1 in. (25.4 by 25-mm) faces. The former may in some cases be preferable because of the larger gripping area



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which leads to reduce slippage. While both sizes of gripping surface are permitted, the size used for carrying out the test must be recorded in the report.

**16.4 Insertion of Specimen in Clamps**—Insert the specimen in the clamps so that approximately the same length of fabric extends beyond the jaw at each end. Locate the jaws centrally in the widthwise direction by having the line which was drawn 1.5 in. (37 mm) from the edge of the specimen run adjacent to the side of the upper and lower jaw which is nearest this edge. This ensures that the same lengthwise yarns are gripped in both clamps.

### 17. One-Inch Raveled Strip Test, 1R

**17.1 Size of Test Specimen**—Cut each specimen 1½ in. wide or 1 in. (35 mm or 25 mm) plus 20 threads, whichever is the larger; the length shall be at least 6 in. (150 mm) (Note 19). Ravel ¼ in. (5 mm), or 10 threads, from each side, so that the resulting specimen has a width, excluding fringe, of 1 in. (25.4 mm) (see 5.4 and Notes 4 and 20).

**17.2** When the breaking load of wet specimens is required, the specimen length must be modified as directed in 16.2.

**NOTE 19**—Neither the raveled strip nor the modified grab test is suitable for measuring the breaking load of "dipped" fabrics.

**NOTE 20**—It may be desirable under some circumstances to ravel the strip to a constant number of yarns instead of a constant width. This number shall never be less than 20 and the width never less than ¼ in. (5 mm). This technique is particularly useful when it is desired to compare the breaking load of a conditioned fabric after a wet finishing operation with that of the same fabric before finishing, if the finishing has caused shrinkage. Such a procedure may be used by mutual consent of the interested parties.

**17.3 Size of Jaw Faces**—For all strip tests or for narrow fabrics and tapes being tested full width, use clamps having jaw faces at least ½ in. (10 mm) wider than the specimen being tested. The faces shall measure at least 1 in. (25 mm) in the direction of application of the load.

### 18. Two-Inch (50.8-mm) Raveled Strip Test, 2R

**18.1 Size of Test Specimen**—Cut each specimen to a width of 2½ in. (65 mm) or 2 in. (50 mm) plus 20 threads, whichever is the larger; the length shall be at least 6 in. (150 mm) (Note 16). Ravel ¼ in. (5 mm) or 10 threads from each side so that the resulting specimen has a width, excluding fringe, of 2 in. (50 mm) (see 5.4 and

Notes 3, 4, and 20).

**18.2** When the breaking load of wet specimens is required, the specimen length must be modified as directed in 16.2.

**18.3 Size of Jaw Faces**—See 17.3.

### 19. One-Inch (25.4-mm) Cut Strip Test, 1C

**19.1 Size of Test Specimen**—Cut each specimen 1 in. wide by at least 6 in. (256.4 mm by 150 mm) long (Note 16), taking care that the long dimension is accurately parallel to the direction for which the breaking load is required (see 5.5).

**19.2** When the breaking load of wet specimens is required, the length must be modified as directed in 16.2.

**19.3 Size of Jaw Faces**—See 17.3.

### 20. Two-Inch (51-mm) Cut Strip Test, 2C

**20.1 Size of Test Specimen**—Cut each specimen 2 in. wide by at least 6 in. long (50.8 mm by 150 mm) (Note 16) taking care that the long dimension is accurately parallel to the direction for which the breaking load is required (see 5.5).

**20.2** When the breaking load of wet specimens is required, the length must be modified as directed in 16.2.

**20.3 Size of Jaw Faces**—See 17.3.

### 21. Modified Grab Test, MG

**21.1 Size of Test Specimen**—Cut each specimen 4 ± 0.1 in. (100 ± 2 mm) wide by at least 8 in. (200 mm) long. The specimen must extend through the jaws and project at least ½ in. (10 mm) at each end. Specimens for insertion using alternative high-strength fabric method (Note 21) must be cut at least 16 in. (400 mm) long. Draw a line 1.5 in. (37 mm) from the edge of the specimen, running its full length. Cut slits at the center of each specimen, perpendicular to the yarn component being tested, severing all yarns except those comprising the central 1 in. (25.4 mm), as shown in Fig. 1.

**NOTE 21**—Where yarns per inch are less than 25, the nearest whole number of yarns just less than those comprising 1 in. (by physical count) shall be left uncut and the test results shall be interpolated to the actual 1-in. count.

**21.2 Size of Jaw Faces**—The top (or front) jaw faces shall measure 1.25 in. by 2 in. (30 by 50 mm) or more, the longer dimension parallel to the direction of application of load. The bot-

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tom (or back) jaw faces shall measure 2 by 2 in. (50 by 50 mm) or more.

**21.3 Procedure**—For fabrics that can be satisfactorily gripped and held in the manner prescribed for the grab method, follow the procedure described in 16.4. For high-strength fabrics where the specimen cannot be satisfactorily held in clamps, use the following procedure:

**21.3.1** Place each specimen between the jaws as illustrated in Fig. 2, using jaw padding if desired.

**21.3.2** Tighten clamps to afford distribution of holding pressure along the surface of top (front) jaw and around pin. Clamps too tight will produce breaking at front of jaws; clamps too loose, breaking at back of jaws at pin.

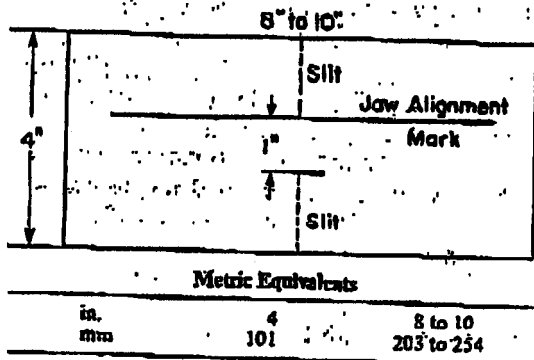


FIG. 1 Illustration of Modified Grab Test Specimen

**21.3.3** Mark across the specimen at the front edge of each jaw to observe specimen slippage.

**21.3.4** If the break occurs in the jaws or at the edge of the jaws, if some yarns fail to break, if specimen slippage is not uniform between either pair of jaws evidenced by distortion of jaw marks or angular displacement of either pin, or if rupture follows any other than random pattern, discard the test result and break another specimen.

## 22. Indexing Terms

**22.1** These test methods are indexed under the following terms: breaking-strength, fabric; elongation, fabric; knitted-fabric; nonwoven-fabric; and woven-fabric.

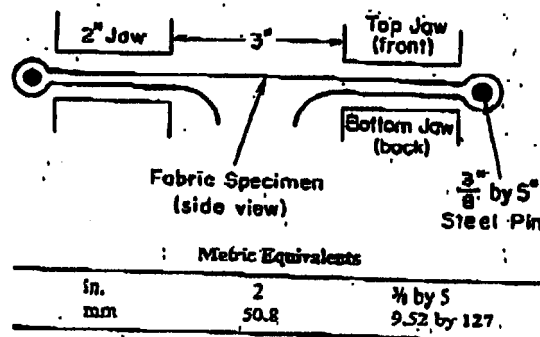


FIG. 2 Illustration of Specimen Placement for Modified Grab Method

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